16 April 2018

Fact Sheet

YOUNG DEFENCE SCIENTISTS PROGRAMME

The Young Defence Scientists Programme (YDSP) is an initiative by the Defence Science and Technology Agency (DSTA) and DSO National Laboratories (DSO). Established in 1992, the YDSP nurtures students' interest in defence science and technology by providing a diverse range of activities including customised programmes, camps and projects.

The YDSP experience also provides students with insights into the careers of professionals in the Defence Technology Community, and recognises top young minds through the YDSP Academic Award, YDSP Scholarship and DSTA Junior College Scholarship.

More than 260 students from 19 Integrated Programme (IP) schools participated in the Research@YDSP and YDSP World of Science (WOS) programmes in 2017.

Research@YDSP

The Research@YDSP is a four-month project attachment which offers students the chance to learn engineering techniques and experience research work under the mentorship of research staff and engineers from DSTA, DSO, Temasek Laboratories, universities and research institutes.

Some 50 projects were completed under the *Research@YDSP* last year. Three of these projects were presented on stage at the YDSP Congress 2018:

- The **"Image Classification via Machine Learning"** project explored image classification algorithms and evaluated their suitability for use in defence and security applications. Machine learning techniques were applied to train AI algorithms to identify objects in videos. The project has the potential of enhancing security by quickly uncovering potential threats in cluttered environments with many objects of similar shape or colour. The project was done by Valerie Tan from Dunman High School, with project mentors Lo Man Ling and Akash Philip from DSTA. This project also received a special award from the Singapore Association for the Advancement of Science for good poster design and presentation at the Singapore Science and Engineering Fair 2018.

- The "**Reaction Wheel Actuator for All Terrain Locomotion**" project aimed to develop a simple, compact, yet practical solution for robots to move over complex terrains. The team constructed their own reaction wheel actuator which allows the robot to "flip" across ground surface. With this solution, the robot is able to navigate on a variety of surfaces. While others, like Massachusetts Institute of Technology, have explored this method before, their reaction wheel could often only be used in conjunction with other mechanisms, like magnets. However, the team was able to engineer their own feedback loop which enables them to control the torque output, allowing the robot to achieve locomotion independently. This project was done by Hubert Choo from River Valley High School, Lim Zinn-E, and Jerald Siah from Raffles Institution with their project mentor, Yap Yong Keong from DSO.

- The "**Bio-inspired Micro Air Vehicle (MAV) for Indoor Application**" project was undertaken by Song Qiuyan from National Junior College and Ren Yu Heng from Dunman High School, and involved the adaptation of a hummingbird-inspired flapping wing MAV design provided by their project mentor, to a rotary-wing mechanism bicopter. The bicopter was designed to achieve greater agility for indoor applications compared to a quadcopter model, and the duo sketched the components from scratch in SolidWorks, a solid

modelling computer-aided design programme. Following this, they 3D printed parts and used CNC-Milling techniques to cut the carbon fibre to create the components to assemble the structure. This project was overseen by Dr Nguyen Quoc Viet from Temasek Laboratories.

World of Science (WOS)

This informative series of lectures and laboratory sessions exposed students to advanced science topics beyond the school curriculum. Conducted by engineers and scientists from DSO and other institutes, the modules delves in the field of physical sciences and infocomm technologies that are critical to Singapore's defence needs. These modules are held during the June school holidays.

Modules include:

- Aerodynamics
    - This module includes lectures on aerodynamics, a workshop with Singapore Youth Flying Club where students have the opportunity to fly onboard the Diamond Aircraft 40, a hands-on activity where students had to build their very own glider, and a site visit to the Republic of Singapore Air Force Murai Camp.

- Artificial Intelligence
    - The three-day workshop provides the participants with an overview of the science behind Artificial Intelligence (AI) and its technological applications such as Natural Learning Processing and Deep Learning. Students also have the chance to "teach" the AI system to recognise gestures using image analysis.

- Cryptography
    - This five-day lecture provides an in-depth look at the intricate world of Applied Mathematics. On the last day, Crypto-Math puzzles will be given to participants to put what they have learnt to the test.

- Computer Security

    - This module immerses participants in the latest developments of computer security. Hands-on activities include exploring how computer games are programmed and the programming of a microprocessor to launch missiles.

- Electromagnetics
    - This four-day workshop consists of lectures and experiments on electromagnetics concepts and advanced applications.

- Robotics
    - Over the length of five days, participants have the opportunity to find out how electronic devices work and to carry out exploration on their own. The module culminates with participants competing against each other in a friendly match using autonomous robots built and programmed by themselves.

- Signal Processing
    - This five-day module consists of lectures and hands-on coding experiments where participants learnt to analyse speech, image, and radar signals.

YDSP Academic Award

- 108 YDSP Academic Awards were given out this year. The award recognises outstanding academic achievements in Mathematics and Physics, and is presented to the top students in Mathematics and Physics from IP Year 3 to Year 6.

- Each recipient will receive S$200.

YDSP Scholarship

- 30 YDSP Scholarships were awarded this year. The scholarship recognises academic excellence and an interest in Science & Technology in particular. It is open to science students in IP Year 3.

- All applicants must be Singapore Citizens with good records of academic results and a passion for science and technology.

- Scholarship recipients will receive S$1,000 over two years.

DSTA Junior College Scholarship

- 29 DSTA Junior College Scholarships were awarded this year. The scholarship recognises outstanding academic achievements in Science, and is open to science students in their first year of junior college studies or equivalent.

- Scholarship recipients will receive S$2,000 over two years.

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